STUDY OF

PARAFALCINE MENINGIOMAS

(A PROSPECTIVE STUDY)

Dissertation

Submitted in partial fulfillment of the degree of

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CERTIFICATE

This is to certify that the dissertation titled **"STUDY OF PARAFALCINE MENINGIOMAS - A PROSPECTIVE STUDY"** of **Dr. M. M. SANKAR** in partial fulfillment of the requirements for **M.Ch. Branch – II (Neurosurgery)** Examination of the Tamilnadu Dr. M.G.R. Medical University to be held in February 2006. The period of study was from January 2001 to August 2005.

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DECLARATION

I, **Dr. M.M. SANKAR** solemnly declare that dissertation titled, **"STUDY OF PARAFALCINE MENINGIOMAS - A PROSPECTIVE STUDY**" is a bonafide work done by me at Govt. Stanley Medical College & Hospital during Jan. 2001- Aug. 2005 under the guidance and supervision of my Unit Chief **Prof. K. DEIVEEGAN, M.S., M.Ch. (Neuro)** Professor and Head of the Department of Neurosurgery.

The dissertation is submitted to Tamilnadu, Dr. M.G.R. Medical University, towards partial fulfillment of requirement for the award of **M.Ch. Degree (Branch – II) in Neurosurgery five years course.**

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CONTENTS

STUDY OF PARAFALCINE MENINGIOMAS (A PROSPECTIVE STUDY)

INTRODUCTION

The parafalcine meningiomas are the meningiomas, which include the parasagittal meningiomas, and the falx meningiomas. The term parasagittal meningioma applies to those tumours involving the superior sagittal sinus and the adjacent convexity dura. Only the lateral wall of the superior sagittal sinus may be involved or the tumour may grow partially or totally occlude the sinus. The involvement of the overlying bone may occur with or without hyperostosis.

The falx meningiomas are the one arising from the falx that is completely concealed by the overlying cortex and typically does not involve superior sagittal sinus when small. Large tumours, may involve the superior sagittal sinus.

While considering the symptoms and the surgical aspects of parafalcine meningiomas it is useful to divide them into anterior, central and posterior third, in relation to the superior sagittal sinus. Those tumours arising from central third segment are the most common and they present with motor and sensory seizures and gradual

progression of the neurological deficit, which initially starts in the lower extremities.

The Meningiomas arising from the anterior third segment tends to be more insidious in onset and often become large before diagnosis is made. The headache is the commonest symptom. The personality change may be there, up to the level of dementia, and seizure is infrequent.

The Meningiomas arising from the posterior third segment often present with headache and the symptoms of increased intracranial pressure and the visual symptoms in the form of field defect.

Cushing and Eisenhardt defined the parasagittal meningiomas as the one that fills the parasagittal angle with no brain tissue between the tumor and the superior sagittal sinus. They defined the falx meningiomas separately, whereas the other investigators such as Elsberg and Olivecrona and Merrem grouped all parasagittal meningiomas with the falx meningiomas. The basis for the surgical management of the parafalcine meningioma is described in this prospective study.

AIM OF THE SYUDY

It is a prospective study on the symptoms, signs, management of parafalcine meningiomas. This work is compared with related works available in the literature. The period of study is between January 2001 to August 2005.

REVIEW OF LITERATURE

Felix Plater, a Swiss physician, has been credited with the first description of meningiomas in 1614.

The French surgeon, Antoni Louise, published, in 1774, the fungoid tumours of the dura. In 1863, Virchow was the first to note the presence of granules in these tumours and named them psammoma bodies.

In 1990, AL-RODHAN and LAWS[1] published a historical account of meningiomas and its surgical management. They noted that the meningiomas have left their mark in the form of hyperostosis in skull as far back as prehistoric times. In 1991, BAKAY also wrote on the same subject.

In the 18th and 19th centuries, meningiomas were diagnosed during life only if they caused changes in the overlying skull that could be appreciated by inspection and palpation.

Only a few attempts were made to remove these lesions surgically, and few were beneficial to the patient. Of the 13 such operation performed between 1743 and 1896 whose outcome was specified by AL-RODHAN and LAWS**,** [1] 9 ended in death.

In 1864, JOHN CLELAND, professor of anatomy in Glasgow suggested that two tumours, which he found in the dissecting room, one of them arising from the cribriform plate of ethmoid and other from the right frontal region adjacent to the superior sagittal sinus, took their origin from the arachnoids rather than dura.

In 1915, CUSHING and WEED reconfirmed the CLELAND`S opinion that the meningiomas did indeed are derived from arachnoids cell cluster.

Initially HARVEY CUSHING proposed the term meningo-theliomas in an effort to describe these tumours according to their tissue of origin. Later HARVEY CUSHING opted the term MENINGIOMAS to refer to these tumours. In his Cavendish lecture in 1922, he reported 85 cases of meningiomas.

In 1938, HARVEY CUSHING and EISENHARDT[7] published a monogram on meningiomas as, “The meningiomas: Their classification, regional behavior, life history and surgical end results” in which they reported in detail about 313 patients encountered between 1903 and 1932.

In the three decades spanning the period from 1936 and 1996 of about 1078 patients with verified meningiomas, 916 were purely

intracranial. These were treated under supervision of Wylie McKissock and great majority were operated on by his team.

OLIVECRONA[8] who in a similar period between 1924 and 1954 had under his care, 1004 patients with verified intracranial meningiomas in Stockholm The interest in meningiomas has not declined since.

In 1922**,** HARVEY CUSHING wrote, "There is today nothing in the whole realm of surgery more gratifying than the successful removal of meningiomas with subsequent perfect functional recovery". These words stand true even today.

HARVEY CUSHING AND EISENHARDT,[7] were the pioneers in reporting the parasagittal meningiomas and falx meningiomas. The others who have done many works on these tumours are OLIVECRONA, ELSEBERG, and MERREM.

The paucity[28] of large published series, their conflicting conclusions, and a degree of dissatisfaction regarding the operative mortality, recurrences, and postoperative late outcome from reports published before the microsurgical era means that there are no definitive guidelines for managing patients with meningiomas. This has made this subject, to quote one of the leading surgeons in the field, "One of the most neglected problems in the brain"

In 1922, HARVEY CUSHING has reported that meningiomas comprised 11.3% of his 751 intracranial tumours and 32% of these tumours were parasagittal meningiomas. The subsequent large series have shown that parasagittal meningiomas accounts for 17 to 32% of all meningiomas.

HARVEY CUSHING first suggested the name, parasagittal for meningiomas along the superior sagittal sinus in 1922. The practical operative criterion proposed by Cushing for distinguishing tumours of the falx cerebri rests on its complete concealment by overlying cerebral cortex. The parasagittal meningiomas were seven times more frequent than falx tumours in Cushing's series. Cushings found hyperostosis of the skull associated with one fourth of parasagittal meningiomas but not with meningiomas limited to the falx.

In the series of, Robert G. OJEMANN[2] there were 43 patients consisting of 32 female and 11 male, ranging in age from 25 to 81 years with, 11 patients over the age of 70 years.

In reviewing 154 parasagittal meningiomas, P.C. GAUTIER-SMITH[33] found that 62% at presentation had seizure, 54% had headache, 49% had unilateral weakness and 43% had mental symptoms.

Of the 43 patients reported by OJEMANN[2] in 27 patients the edge of Superior Sagittal Sinus was involved. In all of these patients, a

gross total resection was accomplished by opening the Sinus and resecting it, but there was often not more than 1 or 2 mm of margin between the tumour and edge of resections. In 24 of the 27 patients there was a good result, three had a fair result because of significant preoperative deficit that did not fully recover.

Two patients have had recurrence of the tumours 3 and 11 years after the first operation respectively. In both, gross total removal was done subsequently with full recovery. In 17 patients, follow-up scans did not show any recurrences over a period of 1-10 years (Mean, 4.6 years).

In 16 patients, there was extensive involvement of the superior sagittal sinus. Six patients with tumours in the anterior third had complete removal with a good recovery and there has been no tumour recurrence. Ten patients had tumours in the middle third. They often had more deficits preoperatively and frequently had temporarily increased hemiparesis or sensory loss post operatively. In six patients, there was significant postoperative worsening that improved in weeks or months, but in two of these patients, a moderate paralysis persisted. Five patients had a good result and five a fair result. Three of the patients with fair result were the same or better than before the operation but still had residual preoperative disability and two had new postoperative

disabilities. In six patients, it was possible to do a total removal because the tumour occluded the sinus. In the other four, tumours were left in the wall of the patent sinus. Follow-up scans from 1 to 4 years have shown no change in three. In the other patients gradual regrowth of tumour was noted on scan but it was not symptomatic until 7 years after operation, when seizure recurred. Angiography showed the sinus to be occluded and a total removal was done subsequently.

GIOMBINI et al[4] 19 reported that in 27 anterior third cases, 17(63%) patients had no disability and 10 (37%) patients had partial disability. In 69(77%) central third cases 36 had no disability, 53 had partial disability and four (6%) had complete disability. In 11 posterior third cases 5(45%) had no disability and six (35%) had partial disability.

GIOMBINI[4] et al in his series concluded that the mortality rate for parasagittal meningioma is 3.7% and for falx meningioma is 13.4%.

LOGUE[6] et al concluded that the mortality rate for parasagittal meningioma is 4.4% and for falx meningioma is 2.4%.

KALLIO[13] et al in his series concluded that the mortality rate for parasagittal meningioma is 12.6% and for falx, meningioma is 14.2%.

McCarthy's[3] et al study, the 5-years tumours recurrence rate for benign completely ressected parasigittal meningiomas is 20.5%.

In the OJEMANNS[2] series, among the 14 patients included were 9 females and 5 male ranging in age from 10 to 90 years with 2 patients over, 70 years of age. Of the 14 patients, 13 had a good outcome and 1 was better but had residual preoperative deficits.

Total removals were done in 12 patients. One had a subtotal removal because of tumour involvement with anterior cerebral artery and one had a radical subtotal removal because of tumour in the inferior wall of a patent sagittal sinus. Three patients had significant temporary worsening but recovered over weeks to months. There has been no evidence of recurrence in any patient, including those with subtotal removal over 8 years.

OLIVECRONA[8] was the first to distinguish parasagittal meningiomas according to their site of origin along the sagittal sinus. He reported that 52% of parasagittal meningiomas involved the central third of the sinus, 37% attached to the anterior third of the sinus, and 11% were attached to the posterior third sinus. 13 of the 27 cases of parasagittal meningiomas showed evidence of bilateral growth.

GOLDSHER et al[5] have summarized the literature on the parasagittal meningiomas. The "Dural tail" sign is a specific feature of

meningiomas in MRI BRAIN with contrast. The problem is that there have been limited numbers of pathologic studies of the dural tail sign. The "Dural tail" sign is due to reactive connective tissues, increased blood vessels, and tumour invasion.

NAKAU[17] H et al have reported pathological significance of meningeal enhancement ("flare sign") of meningiomas in MRI BRAIN. The purpose of their study was to clarify the pathological features and clinical significances of the meningeal enhancement of the surroundings, ("flare signs") on contrast-enhanced T1W images. The marginal dura of the tumours was resected from nine cases of parasagittal meningiomas exhibiting a "flare sign" and used for histopathology evaluation. Connective tissue proliferation was found in three, and tumours cell nest were observed in four cases. In one case tumour cell was found 4.5 mm from the edge of the tumour. In another case, a meningothelial cell cluster was found. They concluded that tumour cell nest was present frequently in the dura that exhibit the "flare sign" and that dura near these lesions should be resected as widely as possible.

Radical resection of meningiomas invading the superior sagittal sinus presents several hazards. Some surgeons consider superior sagittal sinus invasion a contraindication for complete resection, and others advocate total resection with venous reconstruction. There is a

lack of published large series to provide definitive guidelines for the surgical treatment of these complex cases**.**

LARSON JJ[24] et al have reported association of meningiomas with dural “tails” and its surgical significance. Intracranial meningiomas are characteristically benign tumours with a tendency to recur following surgical resection. They have investigated the pathogenesis of meningioma recurrence. In their initial studies, they identified two cases of dural "tails" associated with intracranial meningiomas. Gadolinium-enhanced magnetic resonance images were utilized to identify the dural "tails" preoperatively. Histopathological confirmation of meningotheliomatous cell infiltration into the dural "tails" demonstrated their surgical significance.

BOZZAO A[22], et al has given an elaborated account of a role of contrast-enhanced MR venography in the preoperative evaluation of parasagittal meningiomas. Parasagittal meningiomas may pose a difficult surgical challenge since venous patency and collateral anastomoses have to be clearly defined for correct surgical planning. The aim of this study was to assess the diagnostic value of contrast-enhanced magnetic resonance venography in the preoperative evaluation of venous infiltration and collateral venous anastomoses in patients with parasagittal meningiomas.

Contrast-enhanced magnetic resonance venography was compared with phase-contrast magnetic resonance angiography, conventional angiography, and surgery as a reference. Twenty-three patients undergoing surgery for meningiomas located adjacent to the superior sagittal sinus were prospectively evaluated. All the patients underwent both conventional MRI and magnetic resonance venography. This was performed by means of phase-contrast and contrast-enhanced techniques. Both sets of phase-contrast and contrast-enhanced angiograms were evaluated by two expert neuroradiologists to assess (1) patency of the sinus (patent/occluded), (2) the extent of occlusion (in centimeters), and (3) the number of collateral anastomoses close to the insertion of the meningioma. Eight patients underwent digital subtraction angiography. All patients were operated on, and intraoperative findings were taken as the gold standard to evaluate the diagnostic value of magnetic resonance angiography techniques. Phase-contrast magnetic resonance venography showed a flow void inside the sinus compatible with its occlusion in 15 cases, whereas contrast-enhanced magnetic resonance venography showed the sinus to be occluded in five cases. Contrast-enhanced magnetic resonance venography data were confirmed by surgery, showing five patients to have an occlusion of the superior sagittal sinus. The phase-contrast

magnetic resonance venography sensitivity was thus 100% with a specificity of 50%. In those cases in which both magnetic resonance venography techniques documented occlusion of the superior sagittal sinus, the extent of occlusion was overestimated by phase-contrast compared with contrast-enhanced and surgery. Contrast-enhanced magnetic resonance venography depicted 87% of collateral venous anastomoses close to the meningioma as subsequently confirmed by surgery, while phase-contrast showed 58%. In the preoperative planning for patients with meningiomas located close to a venous sinus, contrast-enhanced-magnetic resonance venography provides additional and more reliable information concerning venous infiltration and the presence of collateral anastomoses compared with phase-contrast sequences.

DIMECO F[20] et al in his 15-year experience with surgery on parasagittal meningiomas invading the superior sagittal sinus between 1986 and 2001 had 108 patients in his series (73 women, 35 men; age range, 22-83 yr; mean age, 56.2 yr). Parasagittal meningiomas not invading the superior sagittal sinus were excluded from his study. Simpson Grade I to II removal was achieved in 100 patients. Thirty patients with meningiomas totally occluding the superior sagittal sinus had complete resection of the encased portion of the sinus. Histological examination revealed 86 benign (79.6%), 16 atypical (14.8%), and 4

malignant (3.7%) meningiomas along with 2 hemangiopericytomas. There were two perioperative deaths. Serious complications included brain swelling (9 patients; 8.3%) and postoperative heamatoma (2 patients; 1.85%). Follow-up ranged from 19 to 223 months (mean, 79.5 months). One patient was lost to follow-up. Tumors recurred in 15 patients (13.9%). After multivariate analysis, histological type, tumor size, and Simpson grade were confirmed as significant independent prognostic factors for recurrence. Author concluded based on his results, that if the sinus is partially invaded, it could be opened to obtain as complete a resection as possible and to attempt to preserve the patency of the sinus. If the sinus is obstructed, the portion of the sinus involved can be resected completely. In both situations, extreme care is vital to preserve the cortical veins, which may offer important collateral drainage. With his approach, good results were achieved.

TIMORI[21] et al 21 presented cases of likely post-traumatic intracranial meningiomas. The relationship between head injury and subsequent development of meningioma remains a controversial and fascinating subject.

Accidentally detected brain tumors are defined as those, whose complaints or neurological deficits were not caused by the brain tumors. For example, patients with a headache, which was considered,

unrelated to the presence of a tumor were included in this series. In the study by KAMIGUCHI H[30] et al one hundred and ten (9.5%) of the 1,155 cases were found to be accidental. Since three accidental cases had multiple meningiomas, there were 113 accidental brain tumors, which involved 63 meningiomas, and the remaining were pituitary adenomas, gliomas, metastatic tumours. Meningiomas occurred significantly more frequent than other types of accidentally identified tumors. Convexity meningiomas and falx meningiomas accounted for 53.9% of the accidental meningiomas, whereas parasagittal meningiomas were less frequent. It is of note that three out of four cases with multiple meningiomas were accidental.

SHIINO[27] A et al has reported that Parasagittal or falx meningioma occasionally causes paroxysmal speech disturbance. A 22-year-old and a 46-year-old female harboring meningiomas suffered recurrent episodes of supplementary motor seizures. Magnetic resonance imaging showed the meningioma compressing the left supplementary motor area. Seizures did not recur after total removal of the tumours.

GOYAL A[31] et al has reported a case of falx meningioma associated with acute subdural hemorrhage. He elaborated the possible mechanisms of hemorrhage. He concluded that an early recognition and surgery can prevent neurological deterioration.

Multiple meningiomas are the condition, in which the patient had more than one meningioma in several intracranial locations in the same patient without signs of neurofibromatosis. The incidence of multiple intracranial meningiomas varies from 1 to 10% in different series.

In one of the article, reported by GELABERT-GONZALEZ M[32] et al, dealt with the diagnosis and treatment of multiple meningiomas. The author reported 13 cases of multiple intracranial meningiomas, consecutively operated on at their hospital between 1983 and 2003. All the patients were studied with CT and the last 10 with MRI. In eight patients, all of the tumours were found at the first admission. In the other five, the diagnosis was not established until years after removal of the first meningioma. All the patients showed no manifestations of von Recklinghausens disease. The overall average age at diagnosis was 53.3 years. Seven were females and six males. The predominant site for the meningioma was the parasagittal and falcine region. He concluded that multiple meningiomas do not differ in prognosis from the benign solitary meningiomas.

ZHONGHUA[23] Yi Xue Za Zhi (Taipei) et al 23 has studied the incidence, type of preoperative seizures and predisposing factors for postoperative seizures in meningiomas. Only few studies have reflected the incidence, type of preoperative seizures and postoperative seizures in meningiomas. From his analysis of 323 patients with intracranial meningiomas, aged 10 to 79 years, 98 (30.3%), were found to have different type of preoperative seizures, in 32 (32.7%) of them, the seizures persisted postoperatively. Among 225 patients without preoperative seizures, 39 (17.3%) developed postoperative seizures.

Thus, a history of preoperative seizures is a significant index ($p<0.005$) for predicting the occurrence of postoperative seizures. In 71 patients with postoperative seizures, precipitating factors in the first week were cerebral edemas and heamorrhage at the surgical sites. In the late postoperative periods, the cause of the seizures was tumours recurrence. Patients with parasagittal meningiomas had a higher rate of tumour recurrences.

CHOZICK[9] et al carried out a postoperative analysis. In his study concluded that 88.9% of patients with preoperative seizures have achieved complete control postoperatively.

MELAMED[10] et al concluded that the recurrence for parasagittal meningiomas is 7 out of 24 patients, i.e.: 20.5%, and for falx meningiomas 2 out of 7 patients, i.e.: 5.9%.

Factors, influencing the recurrence rate of intracranial meningiomas in general after surgery have been reported by KUNISHIO[24] K et al. The postoperative recurrence rate was examined to identify correlations with age, location, histology, or extent of surgery (Simpson's[29] grade). There was no significant difference in the recurrence rate among the histological subtypes, but malignant meningiomas and hemangiopericytomas tended to recur earlier. Anterior basal meningiomas demonstrated a higher recurrence rate.

The classification of parasagittal meningiomas by BONNAL and BROTCHI[16] et al helps to decide on the surgical management of parasagittal meningiomas invading the superior sagittal sinus.

type	**Growth of parasagittal Meningiomas**	**Walls invaded**	**State of sinus**
1	Tumour attached to wall only	0	Patent
2	Part of tumour lie in a dural reflection	1	Patent
3	Tumour enters only the lateral recess of sss	1	Patent
4	Lateral wall or roof of the sss is fully invaded	1	Patent

5	Lateral wall and roof of the sss are fully invaded	2	Partially occluded
6	Lateral wall and roof of the sss are fully invaded + opening of contralateral rolantic vein blocked in the superior sagittal sinus	2	Partially occluded
7	Invasion of three sinus walls by unilateral Tumour	3	Completely occluded
8	Invasion of three sinus walls by bilateral Tumour	3	Completely occluded

ADEGIBITE[14] et al used Simpson's classifications to describe the incidence of parasagittal meningiomas and falx meningiomas and extent of surgical removal in 114 cases.

MARIMANOF[15] R O et al concluded that the incidence of parasagittal meningiomas is (17%), 38 out of 225 cases. In addition, he recorded 18%, 24% of them recurred 5, 10 years respectively.

In CHAN[25] et al, 80 out 257-parasagittal meningiomas recurred 13%, 32%, 40% for Simpson's grade 1, 2, 4 removals respectively.

SINDOU[12] et al used autogenous venous graft to repair the superior sagittal sinus

DIAGNOSTIC STUDY

Wide varieties of radiographic imaging techniques are available and they are useful in the diagnosis of parafalcine meningiomas

PLAIN RADIOGRAPHY:

It includes anteroposterior and lateral view of skull X-rays. Plain radiograph of skull taken as a routine and is not any more used to diagnose meningiomas. However, when plain radiograph of skull is made for other reason will show incidental changes. Sir HARVEY CUSHING in his book has given the following points to be noted in plain x-rays skull of patients with meningiomas. These may support the diagnosis of meningiomas. These changes include

1. Intracranial calcification,
2. Hyperostosis,[26]
3. Enlarged vascular channels from hypertrophied meningeal vessels.

Radiographs are useful to the surgeon if a patient has, already had a craniotomy or if a metallic cranioplasty, such as tantalum is in place. In those patients, the x-ray film clearly shows the extent of previous operation, which can assist the surgeon in planning an extension of an existing bone flap. Indirect evidence of meningiomas is demineralization of the sella tursica and shift of calcified Pineal gland.

ANGIOGRAPHY:

An angiography may be useful to serve as a road map for surgery. It is used nowadays in, 1. For preoperative embolization in highly vascular meningiomas, 2. To find out involvement of superior sagittal sinus.

CT BRAIN:

In noncontrast, CT BRAIN appearance of meningiomas is that of a sharply demarcated mass that is isodense (25%), or slightly hyperdense (75%), relative to adjacent brain parenchyma. Following administration of iodinated, water-soluble contrast agent meningiomas enhance homogenously and brightly.

The calcification of various forms may be present upto 20% cases. They may be

1. Tiny and punctuate-psammomatous,
2. Rimlike,
3. Chunky or nodular pattern,
4. Occasionally, entire tumour may become calcified,

Changes in the adjacent bone may be seen in up to 20%, of cases like reactive hyperostosis or bone destructions and there may be buckling or inward pushing of grey-white matter junction.

MRI BRAIN:

MRI BRAIN is the current gold standard procedure for two-dimensional imaging of the meningiomas.

Multiple imaging sequences and multiple planes of imaging are available and bone artifacts do not influence this technique. Better delineation of the tumour extent can be made out by administration of intravenous contrast medium.

An interface is frequently seen as hypointense area between tumour and surrounding brain on T1W and T2W imaging. This hypointense signal is to represent a combination of a preserved, but compressed, arachnoidal plane between tumour and brain as well as compressed venous plexus.

Hypointensity also reflect the amount of intratumoural calcification and in some cases a signal voids approximates the shape of the tumour.

The typical finding in meningiomas is isointense (60-65%), or slightly hypointense (30-35%), relative to grey matter in T1W images, and it is isointense (50%), hyperintense (40%), and hypointense (10%) in T2W images and proton density images. T2W images are much better than CT BRAIN scans in showing the peritumoural edemas.

The DURAL TAIL may be seen in MRI BRAIN with contrast. It is a specific feature of meningiomas as opposed to other extra axial tumours. This tail extends few millimeters from the edge of the base of the tumour. However, when it is several millimeter long or associated with nodularity, it may represent extension of meningiomas through the dura. Otherwise, these dural tails represent hypervascularity of the dura, which has been shown pathologically as dilated vascular channels and vessels.

MANAGEMENT OUTLINE

The initial evaluation of the patient should include careful history taking and clinical findings. For many patients, the only radiographic study needed is MRI Brain.

A CT Brain is obtained when the information about the bone details are needed. The angiography is used when embolization is considered and in those patients in whom more information are needed about the arterial supply and venous drainage. The angiography can be obtained in MRI, MRAngiogram, and MR Venogram. The treatment options are surgery, radiation therapy, combination of surgery and radiotherapy and observation by periodic clinical and MRI evaluation are considered. Keeping in mind the patients expectations and considering the short and long-term benefits and the risks, the treatment should be planned.

In many patients, an operation is clearly indicated because of the increasing disability, radiographic documentation of a surgically treatable tumour and the assessment that, this treatment can be done with an acceptable risk. However in some patients the management decision can be difficult because of minimal or non progressive symptoms and the indolent nature, history of some meningiomas and the

risk involved with the treatment because of the location or the pathologic anatomy, the development of new radio-surgery treatment, the long term results of which, are still unknown and the incidental finding of an asymptomatic meningiomas.

The objective of the operation is total removal of the meningioma including the involved dura and the involved bone. The completeness of surgical removal of the tumour is the single most important prognostic factor. However, this goal must always be tempered by the surgical judgment, which considers that the first priority is to preserve and improve the function.

In some patients in whom total removal of the meningiomas carries a significant risk of morbidity, and it is a better judgment to leave some tumour and plan to follow the patient with clinical evaluation and MRI studies, and perform a further operation at a latter time or use of radiation therapy as indicated.

A radiological investigation involves, MRI Brain to indicate the status of the superior sagittal sinus. The angiography – conventional, or MR Angiogram with MR Venogram to give information of superior sagittal sinus and the relationship of the cortical veins.

This information is very vital particularly in middle third and posterior third lesion in deciding what to do to the superior sagittal sinus

while operation. The planning of surgery involves pre-operative management like steroid administration, positioning during surgery, flap marking, preoperative assessment for surgical removal, further follow up and treatment.

SURGICAL MANAGEMENT:

A) SURGICAL MANAGEMENT OF PARA SAGITAL MENINGIOMAS:

The positioning of the patient is determined by the tumour location. The patient is positioned so that the scalp over the center of the meningiomas is the highest point. For the meningiomas located anterior to the coronal suture, the patient is placed supine with the head slightly elevated. A bicoronal incision is used. For the tumour at the coronal and in the middle third of the superior sagittal sinus, the patient is placed in supine position with head well elevated. The scalp over the centre of the meningiomas should be the highest point. A U^{11}- shaped incision is used, extending 2cm across the midline with the anterior limb at the hairline and the posterior limb well behind the meningiomas. For some tumours at the coronal suture, the skin flap may be turned forward rather then laterally. In posterior one- third location, the patient is placed in lateral position, the head is elevated, and the head is turned to opposite

side, so that the centre of the tumour is the upper most point. A U-shaped incision is usually used.

The skin and the underlying tissue including the pericranial tissue are carefully elevated as one unit. A bone flap that crosses the midline for about 1-2 cm is used. The burr holes are placed across the base on the side of the bone flap and on the each side of the superior sagittal sinus.

If there is bone, involvement more burr holes may be placed near the tumour and occasionally an area of bone attached to the tumour left behind, while the bone flap is turned around it. As the bone is elevated bleeding from the meningeal vessels is controlled with coagulation and the bleeding from the superior sagittal sinus with gelfoam or surgicel.

The dura is opened usually starting anterior to the tumour in which the parasagittal tumour can most often be seen or palpated through the dura. The surgeon then curves the incision laterally and posteriorly around the tumour in a circumferential fashion, staying at least 1cm from any involved dura. Great care is used especially with the central third tumour to avoid injury to cortical veins. The dura is left attached to the tumour.

If the sinus is going to be removed, the dura is then opened on the opposite side, the sinus ligated anterior, and posterior to the tumour. In

some patients the falx is now divided inferior to the tumour. In anterior third meningiomas, the superior sagittal sinus should be excised even if it is still patent. If the sinus is patent, in the middle or the posterior third tumour it cannot be safely be removed, because of cortical venous infarction that will probably occur in the sensory motor cortex and hence only a subtotal excision may be indicated.

In many patients, the tumour involves only the edge or the lateral wall of the sinus and this can be removed. When the sinus is not going to be resected, the dura is cut parallel to the sinus initially, leaving a small plaque of tumour attached to it. The surgeon then comes back after the tumour has been removed to deal with the involved sinus. An internal decompression of the tumour is done. The capsule of the tumour is gradually reflected into the area of decompression. The arachnoidal, pial attachments are progressively divided in the circumferential fashion, and the tumour is separated. The surgeon places the traction on the tumour and avoid as much as possible retraction of the brain tissue. In large tumour the surgeon must be aware of the anterior cerebral artery branches which may be adherent to the deep surfaces of the tumour.

After the tumour that is compressing the brain has been removed, the attention is turned again to the sinus area. Beginning at one end, the lateral edge of sinus is opened; the tumour wall of the sinus is excised.

After cutting 2-3 mm, the two leaves of the sinus are held with the forceps and the edge of the sinus is closed with the running suture. This step is repeated until the attachment has been divided completely and the tumour is removed. The use of various types of grafts to replace or to repair the portion of the superior sagittal sinus has been reported. The area of brain that was compressed by tumour is lined with surgical and using a graft of pericranial tissue from the scalp flap or facia lata, the dural defect is closed.

B) SURGICAL MANAGEMENT OF FALX MENINGIOMAS

Most of these meningiomas can be removed completely and the patient cured. In positioning the patient for the operation, scalp overlying the central portion of the tumour is placed at the highest level. Usually A U-shaped incision is used. A bone flap is elevated, with the care to preserve the pericranial tissue that will be needed for a graft to replace the dural defect.

A special circumstance occurs when the tumour arise over the fronto-temporal junction. Two points should be emphasized. First, the middle cerebral artery branches may be adherent to medial capsule and great care must be exercised in removing this tumour. Second, the some of the dural attachment may extend over the floor of the anterior fossa, sphenoid wing, and floor and anterior wall of the middle fossa. This

dura must be removed, sometimes even into the lateral edge of the superior orbital fissure. The dural defect can usually be repaired by sewing a graft directly to the edge of the remaining dura, using the small needle. After the intracranial dura is sewn, the graft can be tented along the bone edge and then the convexity margin of the dura is closed.

MATERIALS AND METHODS

AGE AND SEX INCIDENCE OF PATIENTS

In this prospective study group of 45 patients of parafalcine meningiomas, during the period between January 2001 to August 2005, 33 were female and 12 were male, a ratio of approximately 3:1, which is equal to that of, varies studies.

The average age of female patients was 39 years, and for male was 38 years. Majority of our patients were in the 4^{th} and 5^{th} decades of life.

PATIENTS AGE AT TIME OF DIAGNONIS IN 45 PARAFALCINE MENINGIOMAS

Age in years	Anterior		Central		Posterior		Total	
	M	F	M	F	M	F	M	F
< 19	0	0	0	0	0	1	0	1
20 - 29	0	0	0	2	0	0	0	2
30 - 39	3	6	1	8	2	1	6	15
40 - 49	3	3	1	9	0	1	4	13
50 - 59	0	1	1	1	0	0	1	2
60 - 69	1	0	0	0	0	0	1	0
> 70	0	0	0	0	0	0	0	0
TOTAL	**7**	**10**	**3**	**20**	**2**	**3**	**12**	**33**

SITUATION OF TUMOURS

Of these, 33 cases were of parafalcine meningiomas and 12 cases were of the falx meningiomas.

In the PARASAGITTAL MENINGIOMAS that were attached to superior sagittal sinus, 13 were in the anterior group, 17 were in the central group and 3 in the posterior group. The central third was the most common and posterior third was the least common in this study.

In the 12 of FALX MENINGIOMAS that were in the anterior were 4, and in the central were 6, and in the posterior were 2. Even in these, central third was the most common and posterior third was the least one.

SITUATION OF 45 PARAFALCINE MENINGIOMAS

Group	Anterior third	Central third	Posterior third	Total
Parasagittal	13	17	3	**33**
Falx	4	6	2	**12**

The situation of the PARASAGITTAL MENINGIOMAS with the reference to the side of origin was in such a way unilateral presentation was noted in 29 cases. And bilateral presentation was noted

in 4 cases. Of the 29 unilateral parasagittal meningiomas, which originated in right side were 16 cases and in left side were 13 cases.

SITUATION OF 33 PARASAGITTAL MENINGIOMAS WITH THE REFFERENCES TO SIDE OF ORIGIN

Type	Anterior third	Central third	Posterior third	Total
Unilateral	11	16	2	29
Bilateral	2	1	1	4

Of the 12 falx, meningiomas arising from anterior were 4 and arising from central was 6, and arising from posterior was 2. And of the 12 falx meningiomas, 5 were unilateral and remaining 7 were bilateral. Of the 7 bilateral falx meningiomas a clear origin from one side was seen in 4 cases and the remaining cases same size was noted on both side.

The ratio of bilateral falx meningiomas is much higher than the ratio of bilateral parasagittal meningiomas. In our series of 12 cases of falx meningiomas, bilateral origin was seen in 7 cases and remaining was unilateral.

PRESENTING SYMPTOMS

The presenting symptoms of parasagittal group of patients are subdivided according to site of attachment of tumour into anterior, central and posterior of parafalcine region. The presenting symptoms varied a good deal and an obvious difference can be seen in the presentation of anterior, central, and posterior group of patients.

In anterior group - headache, epilepsy, intellectual impairment were the most common symptoms.

In central group- epilepsy, weakness on one side of body was the most common symptoms. The type of epilepsy was different being exclusively generalized in the anterior group and more commonly focal in central group.

In posterior group- the mental symptoms, headache and visual symptoms were seen commonly even though the number of the sample is small in our study.

TOTAL SYMPTOMATOLOGY BEFORE THE DIAGNOSIS IN 33 PARASAGITTAL MENINGIOMA

SYMPTOMS	ANT*	CEN*	POS*	TOT*
EPILEPSY-FOCAL	2	7	0	**9**
EPILEPSY-GENERALIZED	6	2	0	**8**
HEADACHE	9	6	2	**17**
WEAKNESS OF ONE SIDE OF BODY	0	10	0	**10**
MENTAL SYMPTOMS	3	2	0	**5**
VISUAL SYMPTOMS	4	2	2	**8**
SPHINCTER SYMPTOMS	1	1	0	**2**
HISTORY OF TRAUMA	2	2	1	**5**
SENSORY SYMPTOMS	0	2	0	**2**

TOTAL SYMPTOMATOLOGY BEFORE THE DIAGNOSIS IN 12 FALX MENINGIOMA

SYMPTOMS	ANT*	CEN*	POS*	TOT*
HEADACHE	1	4	1	**6**
EPILEPSY-FOCAL	0	1	0	**1**
WEAKNESS OF ONE SIDE OF BODY	0	4	0	**4**
MENTAL SYMPTOMS	1	0	0	**1**
VISUAL SYMPTOMS	1	0	1	**2**
SPHINCTER SYMPTOMS	1	0	0	**1**

EPILEPSY

In parasagittal meningiomas, epilepsy as the presenting symptoms in this study was present in 17 out 33 cases. In anterior group, 6 cases had generalized and 2 cases had focal seizures.

In the central group epilepsy were the most important symptoms and had occurred in 9 cases, in view of the fact that these tumours are adjacent to and exerting pressures over motor, sensory area. The seizures were focal in type in most of the cases. The frequency of the seizures again varied greatly from an isolated one to several attack over many years. In the posterior group of patients in the study, none of the patients had seizures. The features of the seizures are summarized into the table.

TYPES OF EPILEPSY AS THE SYMPTOMS IN 9 OUT OF 17 CENTRAL GROUP CASES IN PARASAGITTAL MENINGIOMAS

Focal seizures without loss of conscious	5	55%
Focal motor, sensory seizures	3	33%
Focal seizures with loss of conscious	3	33%
Focal becoming generalized	2	22%
generalized seizures only	1	11%

Of 12 the falx meningiomas only one patient had focal seizure. Epilepsy was less frequent symptoms in falx meningiomas than in parasagittal meningioma group.

HEADACHE

In parasagittal meningiomas, the headache is the most common complaint of the patients in anterior group and present in 9 out of 13 anterior groups of cases. And 4 cases did not complain of headache. The most characteristic type of headache is paroxysmal in nature and not a single patient, complained of constant headache.

The headache was associated with vomiting in 7 cases and which was worse in the morning in all the cases. In 5 cases the headache woke up the patient in the morning due to severity.

In 7 cases the headache was aggravated by coughing, sneezing. All those patients whose headaches were subjected to aggravating factor had papilledema at the time of diagnosis.

In the central group headache were not so common and present in only 6 cases. In posterior group, 2 out 3 patients had headache and paroxysmal in nature and associated with vomiting and both the 2 had papilledema.

In falx meningiomas, the 6 out of 12 cases had headache. In falx meningiomas the incidence and severity of headache is almost same as those found in parasagittal meningiomas.

WEAKNESS

In parasagittal meningiomas, the weakness of one-half of body in this study is relatively uncommon and present only in 10 cases. Both mode of onset of symptoms, and duration varied considerably. In 6 cases weakness of arm, and leg were noted, of which 3 cases the weakness of legs started and later arm weakness developed, and in the reaming 3 cases both leg and arm weakness started simultaneously. The longest duration of weakness noted was 2 1/2 years and shortest duration of weakness noted was 1 week at the time of diagnosis. 5 patients had a sudden weakness of limbs after fits were noted and recovered fully to preictal state after a lapse of 24 hours. Some form of monoparesis, hemiparesis with epilepsy was the most common complaint in central group and occurred in 10 cases. Weakness of leg alone was noted in one case. Weakness of leg and arm in 9 cases. None of the cases had exclusive weakness of upper limb. Development of weakness was mostly gradual and present in all except, in one patient, which was sudden. This patient deteriorated and become unconscious, and decerebrating around 6 A.M in the morning and who was mobilized to

the theatre in 2 hours and was found to have tumour bleed. The histopathology of this tumour was angiomatous and microcytic meningiomas.

In falx meningiomas the weakness of one side of body is more common in central group and was present in 4 cases and is very similar to that found in parasagittal meningiomas.

MENTAL SYMPTON

In parasagittal meningiomas the chief complaint varied from, purely psychiatric symptom such as depression, euphoria to various grade of dementia.

Some patient had mild irritability and memory impairment, with lack of initiatives and tendency to worry over small details, where as the most severely affected had profound dementia and incontinence.

All these symptoms were predominantly present in anterior group when compared with central and posterior group. In anterior group, 3 out of 13 had history of mental symptoms.

Abnormality in mood were commonly present in association with dementia, of which, 2 were depressive, and one were euphoric. None of these patients had previous depressive disorder.

Mental Symptom was not so common in central group, being a complaint in only one patient probably, because the patient presented

with early symptoms of weakness, and focal fits at the time of diagnosis, even when the tumour size was small. The degree of the dementia was not as severe as in anterior group. In both the group mental symptoms for a short duration.

In the falx meningiomas, only one patient had a notable mental symptom in the form of euphoria and this patient had right side falx meningiomas.

VISUAL SYMPTONS

In parasagittal meningiomas, the visual symptoms were noted in 8 patients. The visual symptoms were relatively more common in anterior group than in the central group.

In Anterior group, headache, diplopia were common. All of these patients had papilledema on admission. In this group, 4 out of 17 cases the patients had visual symptoms.

In central group cases, 2 out of 17 cases had visual symptoms, in the form of diplopia due to increased intracranial pressure. In posterior group, 2 out of 3 patients had hemianopia on admission. However, patients were unaware of it.

In falx meningiomas, the 2 patients in the central group had features of diplopia due to increased intracranial pressure.

SPHINCTER DISORDER

Of the parasagittal meningiomas as a whole, 3 patients complained of sphincter disturbances at the time of admission. The incidence was highest in anterior than the central group. The type of disorders like frequency, urgency of micturation and occasional incontinence were noted in all cases.

In anterior group, 2 out of 13 patients had sphincter disturbances. In central group, 1 out of 17 patients had sphincter disturbances. In posterior group, none of the patients had these symptoms.

In falx meningiomas, the sphincter disturbances in the form of uninhibited bladder present in one of anterior group of falx meningiomas.

HISTORY OF TRAUMA

In parasagittal meningiomas as a whole, past history of head trauma was present in 5 patients, among this 2 patients were in anterior group, and 2 patients were in central group and 1 patient in posterior group. None of the patient in falx meningiomas had any history of trauma.

SENSORY SYMPTOMS

In the parasagittal meningiomas, the sensory symptoms like numbness and paraesthesia are common in central group. The entire

symptoms were less than one-year duration. In central group, 4 out of 17 patients had sensory symptoms. The complaints were confined to leg only in 2 cases, and arm and leg in remaining 2 cases. None of the patients in anterior group, and posterior group had these symptoms. None of the patient in falx meningiomas had these symptoms.

SPEECH DISTURBANCES

In the parasagittal meningiomas, speech disturbances like slurring of speech and dysphasia are the most common in posterior group and least common in anterior group. In posterior group, 2 out of 3 patients had the symptoms. In central group, 1 out of 17 patients had the symptoms. In anterior group, none of the patients had the symptoms. None of the patient in falx meningiomas had these symptoms.

ATAXIC GAIT

In the parasagittal meningiomas, the gait abnormalities like unsteadiness of gait, occasional falls, and unsteady on turning were present only in anterior group. In anterior group, 2 out of 13 patients had these symptoms in the absence of any gross neurological deficit in the legs. However, all these patients had impairment of intellectual functions also in the form of dementia and depression. None of the patients in central, posterior group had these symptoms. None of the patient in falx meningiomas had these symptoms.

THE AVERAGE DURATION OF SYMPTOMS BEFORE DIAGNOSIS

A reasonable and reliable estimate of duration of symptoms before diagnosis was obtained in all parafalcine meningiomas. In the parasagittal meningiomas, the average duration for the females is 36 months and for males is 40.5 months. The average duration of symptoms for the three groups measured in months is shown in the table.

THE AVERAGE DURATION OF SYMPTOMS IN 33 PARASAGITTAL MENINGIOMAS (IN MONTHS)

Sex	Anterior	Central	Posterior	Total
FEMALE	25	43	40	36
MALE	45	36	-	40.5
AVEARAGE	35	39.5	40	38

In falx meningiomas, the average duration for the females is 19 months and for males is 22 months. The average duration of symptoms for the three groups measured in months is shown in the table.

THE AVERAGE DURATION OF SYMPTOMS IN 12 FALX MENINGIOMAS (IN MONTHS)

Sex	Anterior	Central	Posterior	Total
MALE	19	17	24	19
FEMALE	23	22	15	22
AVEARAGE	**22**	**20**	**18**	**21**

THE DIFFERENCES IN SYMPTOMATOLOGY BETWEEN FALX AND PARASAGITTAL MENINGIOMAS

The most striking differences between the parasagittal meningiomas and falx meningiomas were the average duration of symptom before diagnosis: i.e., falx meningiomas patients reporting earlier than parasagittal meningiomas group. The duration of symptom before diagnosis for falx meningiomas group is shorter. The duration of symptom was an average of 38 months in parasagittal meningiomas group and 21 months in falx meningiomas group. One possible reason was that the more deeply placed falx meningiomas might well have grown to a large size before giving rise to any symptom than the more superficially placed parasagittal meningiomas group. When the symptom did appear, the patients complained of severe headache and visual failure, which were more common in falx meningiomas group, and were more likely to be investigated thoroughly at an early stage. Another reason for the difference was that epilepsy without physical

sign was a very frequent early symptom in the parasagittal meningiomas group in which on some occasions it persisted for very many years without causing further development and as a result was not investigated.

PHYSICAL SIGNS

In the parasagittal meningiomas, some abnormality was found in 31 out of 33 patients at the time of admission immediately preceding the establishment of a firm diagnosis. A wide variety of physical signs was found in all three groups. In anterior group, papilledema, pyramidal signs were commonly present. In central group, the pyramidal signs were most common and which were rarely bilateral and commonly unilateral. In posterior group, the field defects were common.

PHYSICAL FINDING AT THE TIME OF DIAGNOSIS IN 33 PARASAGITTAL MENINGIOMAS

PHYSICAL SIGNS	**ANT***	**CEN***	**POS***	**TOT***
UNILATERAL PYRAMIDAL SIGN	3	11	0	**14**
PAPILLEDEMA	9	9	2	**20**
SENSORY SIGNS	1	8	0	**9**
SKULL BONE ABNORMALITY	2	0	0	**2**
B/L PYRAMIDAL SIGN	4	2	0	**6**
VISUAL FIELD DEFECT	3	0	2	**5**
DYSPHASIA	1	2	1	**4**

CRANIAL PALSY	2	0	0	**2**
NO ABNORMAL SIGN	1	1	0	**2**
OCCULAR MOVEMENT DEFECT	3	1	1	**5**

PHYSICAL FINDING AT THE TIME OF DIAGNOSIS IN 12 FALX MENINGIOMAS

PHYSICAL SIGNS	**ANT***	**CEN***	**POS***	**TOT***
UNILATERAL PYRAMIDAL SIGN	1	3	1	**5**
PAPILLEDEMA	3	5	2	**10**
SENSORY SIGNS	0	2	0	**2**
SKULL BONE ABNORMALITY	1	0	0	**1**

PYRAMIDAL SIGNS

In the parasagittal meningiomas**,** the involvement of pyramidal system was extremely common and it was present in 20 out of 33 cases, in all groups. It was unilateral in 14 cases, and was bilateral in 6 cases.

PYRAMIDAL SIGNS AT THE TIME OF DIAGNOSIS IN 33 PARASAGITTAL MENINGIOMAS

Sex	**Anterior**	**Central**	**Posterior**	**Total**
UNILATERL	3	11	-	14
BILATERAL	4	2	-	6
TOTAL	7	13	-	20

In all groups, the severity varied greatly. The cases have been placed into three categories depending on the degree of abnormality.

Mild degree had only reflex changes. Moderate degree had marked weakes of limbs but able to use the limbs. Severe degree had profound weakness of the limbs.

SEVEVERITY OF PYRAMIDAL SIGNS AT THE TIME OF DIAGNISIS

	Anterior third	Central third	Posterior third
MILD	5	3	-
MODERATE	2	8	-
SEVERE	-	2	-
TOTAL	7	13	-

In anterior group 7 out of 13 cases showed pyramidal signs, among these cases 5 were mild degree.

In central group 13 out of 17 cases showed pyramidal signs, among these cases 8 were moderate degree.

In posterior, group none of the cases showed pyramidal signs. The site of maximum weakness and spasticity is shown in the following table.

SITE OF MAXIMUM WEAKNESS IN 20 OUT OF 33 PARASAGITTAL MENINGIOMAS

Site	Anterior third	Central third	Posterior third	Total
ARM	0	2	0	2
LEG	1	8	0	9
BOTH	6	3	0	9
FACE	0	0	0	0
TOTAL	7	13	0	20

In central group, the weakness and spasticity were found most commonly in legs. In anterior and posterior groups, these were generalized and were usually down to one side.

In falx meningiomas, the pyramidal signs were found in 5 out of 12 cases. The pyramidal signs found were severe and frequent in central group of patient than in anterior and posterior group. The predominant signs was seen in lower limbs and one patient who had bilateral falx meningiomas in the central group showed bilateral lower limbs weakness predominately bilateral foot drop.

PAPILLEDEMA

In the parasagittal meningiomas, the papilledema was an extremely important sign in all three groups, and it was present in 20 out of 33 cases in all groups. The papilledema was present in almost all cases of bilateral lesion except in one case.

Anterior group were the most commonly affected than in the central group or posterior group and were present in 9 out of 13 cases. In central group, 9 out of 17 cases had papilledema and in posterior groups, 2 out of 3 cases had papilledema.

DISTRIBUTION OF PAPILLEDEMA IN 20 OUT OF 33 CASES OF PARASAGITTAL MENINGIOMAS

	Anterior third	**Central third**	**Posterior third**	**Total**
BILATERAL	9	8	2	19
UNILATERAL	0	1	0	1
TOTAL	**9**	**9**	**2**	**20**

In the falx meningiomas**,** the incidence of papilledema is more common than that was seen in parasagittal meningiomas and it was seen in 10 cases. It is likely that the tumour grows to a larger size than those in parasagittal meningiomas before producing symptoms and signs. Consequently, it is a result of raised intracranial pressure, which is more likely to appear in the falx meningiomas.

DEFECT IN THE VISUAL ACUITY

In this parafalcine meningiomas study none of the patients were affected.

FIELD DEFECT

In the parasagittal meningiomas, the visual field defect was recorded in 5 out 33 cases. In anterior group of patients 3, had a generalized constriction of visual field with papilledema. In posterior group of patients, 2 out of 3 cases had contralateral homonymous hemianopia. In the falx meningiomas, none of the patients had these signs.

DEFECT OF OCULAR MOVEMENT

In the parafalcine meningiomas, the sixth cranial nerve palsy in the form of abduction weakness was present in 5 out of 33 cases of which 3 out of 13 cases in anterior group , and one out of 17 cases in central group, and one out of 3 cases in posterior group. These were unilateral in one case and bilateral in 4 cases. Apart from the lateral rectus palsy no other ocular movement defect were seen in this series. All the above ocular movement defects were the signs of increased intracranial pressure and showed papilledema and disappeared after surgery.

SENSORY SIGNS

In the parasagittal meningiomas, the sensory signs were present in 9 out of 33 cases in all groups, and most common in central group and least common in anterior group.

In central group, 8 out of 17 cases showed sensory signs. In anterior group 1 out of 13 cases showed sensory signs. None of the cases in the posterior group showed any sensory signs. In the falx meningiomas, 2 patients had these signs.

ABNORMALITY OF THE SKULL

In the parafalcine meningiomas, as a whole the abnormality of the skull particularly visible and palpable swellings were important physical signs. In the parasagittal meningiomas, two cases in this study, showed skull bone abnormality. In the falx meningiomas, one case showed skull bone abnormality and that was 11 years old female child with the features of NF 1 and multiple meningiomas.

SPEECH DISTURBANCES

DYSPHASIA: In the parasagittal meningiomas, the speech abnormality in the form of slurring of speech dysarthria was present in 6 cases and distributed to either side tumour and occurred predominantly in the central group of cases. Dysphasia of either motor or sensory was present only in left sided meningiomas. Central group of cases showed motor dysphasia and posterior group of case showed sensory dysphasia. In central group 2 out of 17 cases showed motor dysphasia. In posterior, group one out of 3 cases showed sensory dysphasia. In the falx meningiomas, none of the patients had these signs.

CRANIAL NERVE PALSY

In the parafalcine meningiomas, the cranial nerves palsy that could be detected was only sixth cranial nerves palsy and that is a false localizing sign, and one patient had olfactory nerve palsy, again which is

also a false localizing sign, due to raised intracranial pressure. No other cranial nerve palsy could be detected in this study.

NO ABNORMAL SIGN

At the time of diagnosis, no abnormal sign could be detected in two patients of the parasagittal meningiomas. One patient in anterior group and one in central group had no abnormal sign in the nervous system, and in these patient CT BRAIN was done as the investigative procedure for headache or epilepsy.

HISTOLOGICAL FINDING.

Meningiomas were classified and divided according to by World Health Organization criterion. Benign, mostly meningothelial meningiomas were identified in 43 patients. Atypical meningioma was diagnosed in one patient. The angiomatous with microcytic component was diagnosed in one patient. This patient is one who had recurrence and reoperated had the histological diagnosis of malignant meningioma and this patient died after 30 days of reoperation due to myocardial infarction. This patient during the first surgery had histological diagnosis of meningothelial meningioma.

S.no	W.H.O grade	No of patient
1	MENINGOTHELIAL MENINGIOMA	43
2.	ATYPICAL MENINGIOMA	1
3	ANGIOMATOUS AND MICROCYTIC MENINGIOMA	1
4	MALIGNANT MENINGIOMA (RECURRENCE)	1

MORTALITY AND MORBIDITY:

Mortality and morbidity were noted in this study is 0 and 6.6% respectively. No patient died during perioperative period. However, one patient died of myocardial infarction after reoperation for recurrence, one year after the first surgery for anterior third of parasagittal meningioma.

Overall, morbidity occurred in three patients (6.6%). The most serious complication was the Brain swelling, which occurred after second postoperative day, was confirmed by CT Brain, and was treated intubation, hyperventilation, corticosteroid, and osmotic diuretic. This patient recovered in few days.

One patient developed subgaleal CSF collection on third postoperative day; she was treated with repeated lumbar puncture and

drugs. One patient developed deep vein thrombosis and required conservative measures only.

COMPLICATION:

S.No	Complication	No. Of patients
1	BRAIN SWELLING	1
2	SUBGALEAL CSF COLLECTION	1
3	DEEP VEIN THROMBOSIS	1

DISCUSSION

In this is prospective study of parafalcine meningioma done during the period between January 2001 to August 2005. We have studied the history, clinical findings investigative, surgical procedure, outcome and follow-up of the patients and compared with various studies done as quoted in the bibliography.

Some clinical features were unique for this study with statistical significance while other was comparable to other studies.

SEX INCIDENCE:

In this study of 45 patients, the sex difference of female to male ratio of 3:1 is as comparable to the studies by Ojemann[2] et al and Dimeco[20] F et al. Age incidence of 4th and 5th decades of life is comparable with other studies.

Series	Female	Male	Total
Ojemann et al [2] - Parasagittal cases	32	11	43
Ojemann et al [2] - Falx cases	9	5	14
Dimecof et al [20] - Parasagittal cases	73	35	108
In this study - Parafalcine cases	33	12	45

SITUATION OF TUMOURS:

Situation of the tumours as divided into anterior, central and posterior was studied. The most common situation in this series being central followed by anterior group is also statistically comparable to the most of the studies by Olivecrona[8] et al and Giombini[4] et al and Cushing & Eisenhardt[7] et al series.

S. No	Study series	Tumours	Ant*	Cent*	Post*
1	Cushing&Eisenhardt et al[7]	Parasagittal	34%	57%	9%
2	Cushing&Eisenhardt et al[7]	Falx	43%	57%	0
3	Olivecrona et al[4]	Parasagittal	32%	52%	11%
4	Giombini[4] et al	Parasagittal	25%	64%	11%
5	In this series	Parasagittal	39%	51%	10%
6	In this series	Falx	33%	50%	16%

Studying about the presenting symptoms in this series the symptoms were subdivided according to the site of the attachment of the tumour into anterior, central and posterior parafalcine region.

In the anterior group, headache, epilepsy, unilateral weakness were the most common.

In the central group, hemiparesis and focal epilepsy were common and in the posterior group, headache and visual symptoms were the presenting symptoms even in this small sample of studies.

Unilateral weakness was noted in 10 out of 33 parasagittal and 4 out of 12-falx meningioma at the time of diagnosis. In Gautier and

Smith[33] et al series, and they have noted 75 out of 154 cases which in our study is statistically significant by chi-square test ($Xy^2 = 3.84$, $p = 0.05$).

Mental symptoms were noted in 5 out of 33 patients is also statistically significant by chi-square test ($Xy^2 = 8.86$, $p = 0.002$) against 66 out of 154 cases of Gauthier and smith[33] et al series.

Preoperative seizures as presenting symptoms were noted in 17 out of 33 patients of parasagittal meningioma. These symptoms did not recur post- operatively on follow-up. Probably due to careful taking of anticonvulsants by the patient. But on follow-up of the older patient for whom anticonvulsant was stopped after 3 years of the surgery, there was no recurrence of seizures. This is also statistically significant by chi-square test ($Xy^2 = 21.2$, $p = 0.003$).

Incidental finding of parafalcine meningioma was noted in 2 out of 45 patients in the series. CT scan of the brain was done as a routine investigation for headache without any neurological deficit in these two patients.

4.4% of the patient's study showing parafalcine meningioma is statistically significant in the study ($Xy^2 = 62.6$, $p = 0.001$), when compared to 9.5% of cases seen in Kamiguchi's[30] et al series.

A notable estimate of duration of symptoms before diagnosis was obtained in all parafalcine meningiomas in the series. The average duration of symptoms in parasagittal meningioma is 36-40 months and in falx meningioma is 19-22 months.

This difference of falx meningioma reporting earlier than parasagittal meningioma group may be due to that more deeply placed falx meningioma grows to a large size before giving rise to any symptoms than the more superficially placed parasagittal meningioma. Where the symptoms appear the patients complained of severe headache and visual failure which are common in falx group and are more seeks to be investigatable as soon as the symptom appear.

Another reason being that seizure with any neurological signs are frequent in parasagittal meningioma and present for many years without causing any other symptoms and as a result is not fully investigated for a long duration.

Multiple meningiomas in a patient was noted in one patient in this prospective study as against 13 out of 464 cases of Gelabert-Gonzalez[32] M et al is also statistically significant (Xy^2 = 11.8, p = 0.003).

The most predominant histopathological findings in this study was meningothelial meningioma (WHO Gr.I) (43 out of 45 patients)

against 86 out of 108 patients of Dimeco F[20] et al is also statistically significant ($XY^2 = 6.09$, $p = 0.01$).

One of the case was a typical meningioma (WHO Gr.II) as against 9 out of 108 patients of Dimecof et al is statistically significant ($Xy^2 = 5.10$, $p = 0.02$).

No perioperative death was noted in this study. Micro neurosurgical technique, effective postoperative care can definitely prove this. Various studies shows mortality rate of 2.4% to 14.2%.

1	Logue[6] et al	Parasagittal	4.4%
2	Logue[6] et al	Falx	2.4%
3	Kallio[13] et al	Parasagittal	12.6%
4	Kallio[13] et al	Falx	14.2%
5	Giombini[4] et al	Parasagittal	3.7%
6	Giombini[4] et al	Falx	3.4%
7	In this series	Parafalcine	0%

The aim of the surgery planned in our patients was the total removal of the meningiomas. The macroscopic total removal that was confirmed by postoperative CT BRAIN was possible in 43 out of 45 cases. Among these 31 were parasagittal meningiomas and 12 were falx meningiomas.

Three cases showed bone involvement. Of which two in the parasagittal group, which showed, bone involvement due to meningioma invasion hyperostosis, both of which had bone removal and followed by

cranioplasty using bone cement in the same sitting. One patient belonged to anterior group of falx meningiomas who had features of NF 1 had bony hyperostosis. This patient had the bone removal followed by cranioplasty.

In 30 out of 33 patients of parasagittal meningiomas who had dural involvement, the dura was excised and duroplasty was done using temporalis facia or pericranium in 15 cases, and facia lata graft in 15 cases.

One patient in anterior falx meningiomas with features of NF 1 who had dura and bone involvement in the form of hyperostosis, the meningiomas was removed along with wall of anterior third of superior sagittal sinus and duroplasty was done with facia lata graft followed by cranioplasty.

In dealing with meningiomas it is always planned for total removal and Simpson grade-I, and grade II, was achieved in 43 patients, among this, 31 out of 33 cases of parasagittal meningiomas and all the 12 cases of falx meningiomas.

One patient who had central third parasagittal meningiomas had an injury to major draining vein, the vein of trolad and subsequently brain started swelling. Hence further procedure abandoned with only biopsy of the tumour.

The patient had stormy postoperative period with dense hemiplegia, aphasia. The patient gradually improved. And two years later in the last follow-up, she came with normal walking, speech, and mild flap bulge. The fundus is normal.

Of the 13 anterior parasagittal meningiomas with superior sagittal sinus involvement, 10 had total removal of tumour with the only lateral wall of the sinus involvement. In one case who had dural involvement, with bony erosion, the bone was removed along with involved dura with a small fragment of tumour tissue attached to the sinus wall, left behind. The duroplasty was done with facia lata cranioplasty was done with iliac bone graft, and this patient showed recurrence of falx lesion after one-year duration with bony osteomyelitis and skin excoriation.

This patient was subsequently subjected to recraniotomy, and a total excision of recurrence was done along with the underlying dura and infected bone. Infected scalp was excised, and wound closed without difficulty since the bone was removed. The postoperative period was uneventful and discharged with normal neurological state.

Of the 17 cases of central third parasagittal meningiomas with sinus involvement, total excision was done in 10 cases. Near total excision was done in seven cases. In these 7 cases a small fragment was

left behind which was attached to sinus. Of the 3, posterior group with sinus involvement near total removal was done in all the cases. All the above said cases had patent superior sagittal sinus.

One of the patient, in this study group who was having central third parasagittal meningiomas, became unconscious on the day of surgery and at surgery was found to have acute subdural heamatoma and tumour bleed. The HPE report was angiomatous meningioma possibly explaining the bleeding and deterioration.

Of the 12-falx meningiomas, one patient had features of NF 1. This patient was aged 11years, was a female child was operated for cataract of both the eyes one year back and came with frontal bony swelling. The lenticular calcification is the one of the features of NF 1. This patient had frontal bossing due to hyperostosis, and patient had come to the hospital for cosmetic correction. The patient did not have headache, or any neurological deficit. The fundus was normal .on investigating the patient the x-ray skull was taken and it showed frontal bone hyperostosis and choroids plexus calcification. Then CT BRAIN was taken and it showed choroids plexus calcification, small ventricle and a right posterior parasagittal meningiomas and bilateral anterior falx meningiomas with frontal hyperostosis.

The parasagittal meningiomas was operated in the first sitting, and one week later the falx meningiomas with involved anterior third of superior sagittal sinus and involved dura and involved bone was excised. The duroplasty was done with facia lata and cranioplasty was done with bone cement. The postoperative period was uneventful. This patient was followed up for 3 years and the patient was asymptomatic with no features of recurrences.

RECURRENCE:

Recurrence of 8.8% was noted in this series, against 13.9% of Dimeco F et al series, which is statistically comparable. (Xy^2=0.73, p=0.39). Various studies shows recurrence rate ranging from 13.9% to 20.5%.

S.no	Studies	Recurrence rate
1	Melamed[10] et al	20.5%
2	Dimeco F[20] et al	13.9%
3	McCarthy[3] et al	20.5%
4	In this series	8.8%

FOLLOW UP AND OUTCOME

Only 43 patients were regularly followed up. Each patient was followed up on 2nd week, first month, 3rd month, 6th month, first year, and then every six months. The longest duration of follow up was 36 months. The shortest duration of follow up was 6 months. The mean duration of follow up was 24 months. (N-24 months). Among all parafalcine meningiomas 40 patients out of 43 patients have came for follow up were taking the anticonvulsants regularly, and did not had any symptoms or signs of recurrence. These entire patients were subjected to contrast CT BRAIN at 6th month, first year and second year, from the date of surgery, and radiologicaly there was no recurrences. One patient lost the follow up after 3rd month and another patient who had recurrence and was reoperated and died after 1 month of surgery, due to myocardial infarction.

OUTCOME OF 45 PARAFALCINE MENINGIOMAS.

Outcome	**Patients**
Perioperative death	Nil
Lost to follow-up	1
Alive, no recurrence	40
Unrelated death, after reparation for recurrence	1
Alive, after reoperated recurrence	1
Alive, with small recurrence	2
Total	45

RECURRENCES:

Despite the benign character of meningiomas, the recurrence is problematic one. In our series the, histological type, Simpson's removal grade were the significant independent factors for recurrences. In McCarthy's[3] et al recent study, the 5-years tumours recurrence rate for benign completely ressected parasigittal meningiomas is 20.5%.

In this Parafalcine meningioma study tumour, recurrence was noted in four patients (8.8%). The median time for recurrence was 36 months. Three benign meningiomas and one atypical meningioma had recurred. Among this, one was the patient, who had recurrence, was reoperated and developed infection and died of myocardial infarction, 30 days after the surgery.

One patient who was operated and the histopathological report was angiomatous meningioma had recurrence of symptoms and signs and radiological evidence of a huge recurrence at previously operated site. This patient was also reoperated and total excision was done. The histopathological report of this meningioma was malignant meningioma. This patient was subjected to radiotherapy. Two of the patients with parasagittal meningiomas, operated one year back, in the follow-up CT BRAIN, showed very small recurrence. These patients are being followed up regularly by periodic contrast CT BRAIN.

CONCLUTION

1. The parasagittal meningiomas are more common in female than male in the ratio of 3:1
2. In the parasagittal meningiomas, the commonest location is central group accounting for 23 out of 45 cases.
3. The central groups of patients are more symptomatic than anterior or posterior group before diagnosis.
4. The commonest age group for the parafalcine meningiomas is 4^{th} decade of life.
5. The average duration of symptoms, before diagnosis is, shorter in falx meningioma than parasagittal meningioma.
6. Bilaterality is more common in falx meningioma than parasagittal meningioma.
7. Recurrence rate is not very high.
8. The most common histological type is meningothelial meningioma.

PROFORMA

PATIENT DATA:

CASE NO:

Name:

Age/Sex:

Ip no:

Occupation:

Address:

HISTORY and DURATION: Seizures,
Headache,
Weakness of one side of body,
Mental symptoms,
Visual symptoms,
Sphincter symptoms,
Sensory symptoms,
History of trauma.

EXAMINATIO OF CENTRAL NERVOUS SYSTEM:

Higher function examination: Right: Left:

Cranial nerves examination:

Spinomotor:

Nutrition

Tone

Deep tendon reflexes

Sensation

Gait

Spinal and Cranial tenderness

CLINICAL DIAGNOSIS:

INVESTIGATION:

Blood investigation,

X-rays skull, anteroposterior, lateral view,

CT Brain with contrast.

MRI Brain with contrast

ASSOCIATED DISEASE:

DIAGNOSIS:

SURGERY:

Procedure

Intra-operative finding

Intra-operative complications

POST OPERATIVE:

Neurological status

Complications

CONDITION AT DISCHARGE:

FOLLOW UP:

OUTCOME:

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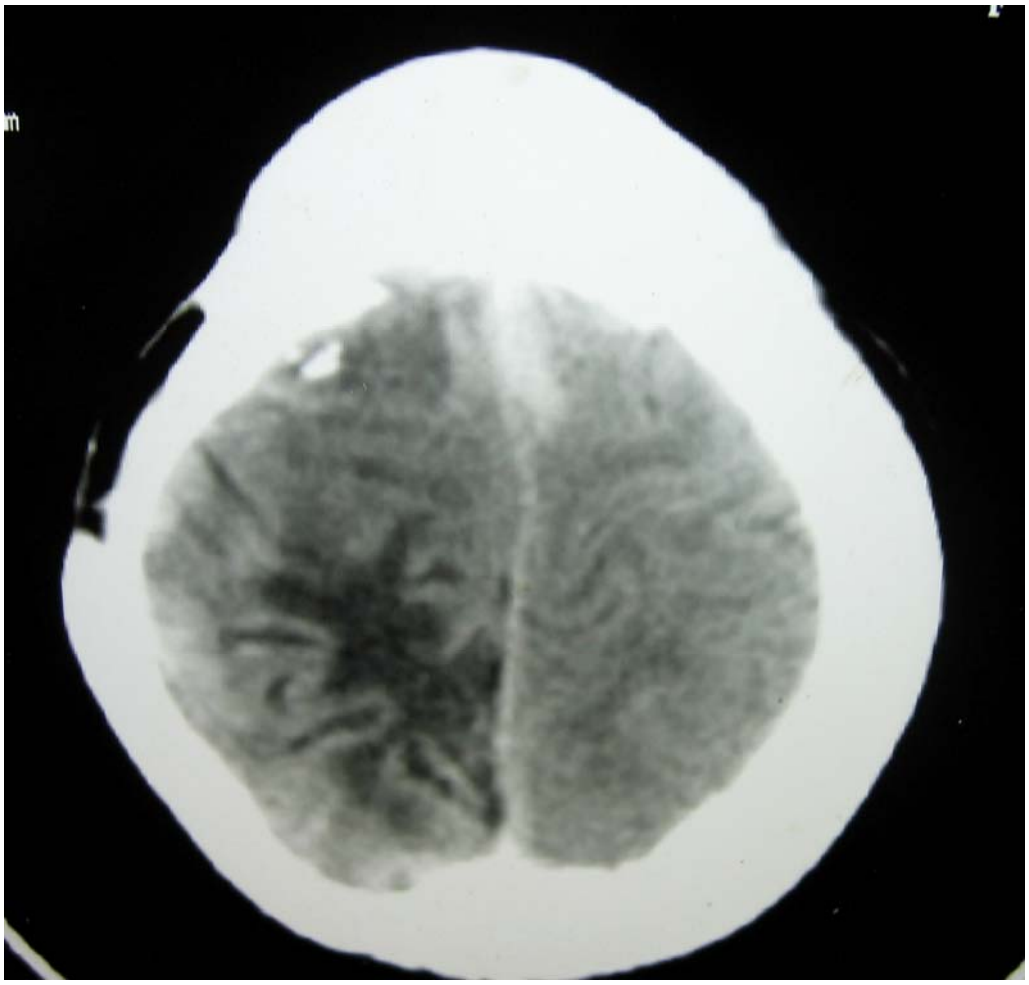
MRS. INDIRA
NO.7 OF MASTER CHART
RIGHT POSTERIOR THIRD PARASAGITTAL MENINGIOMA
POST OPERATIVE PICTURE – CONTRAST CT BRAIN AXIAL VIEW



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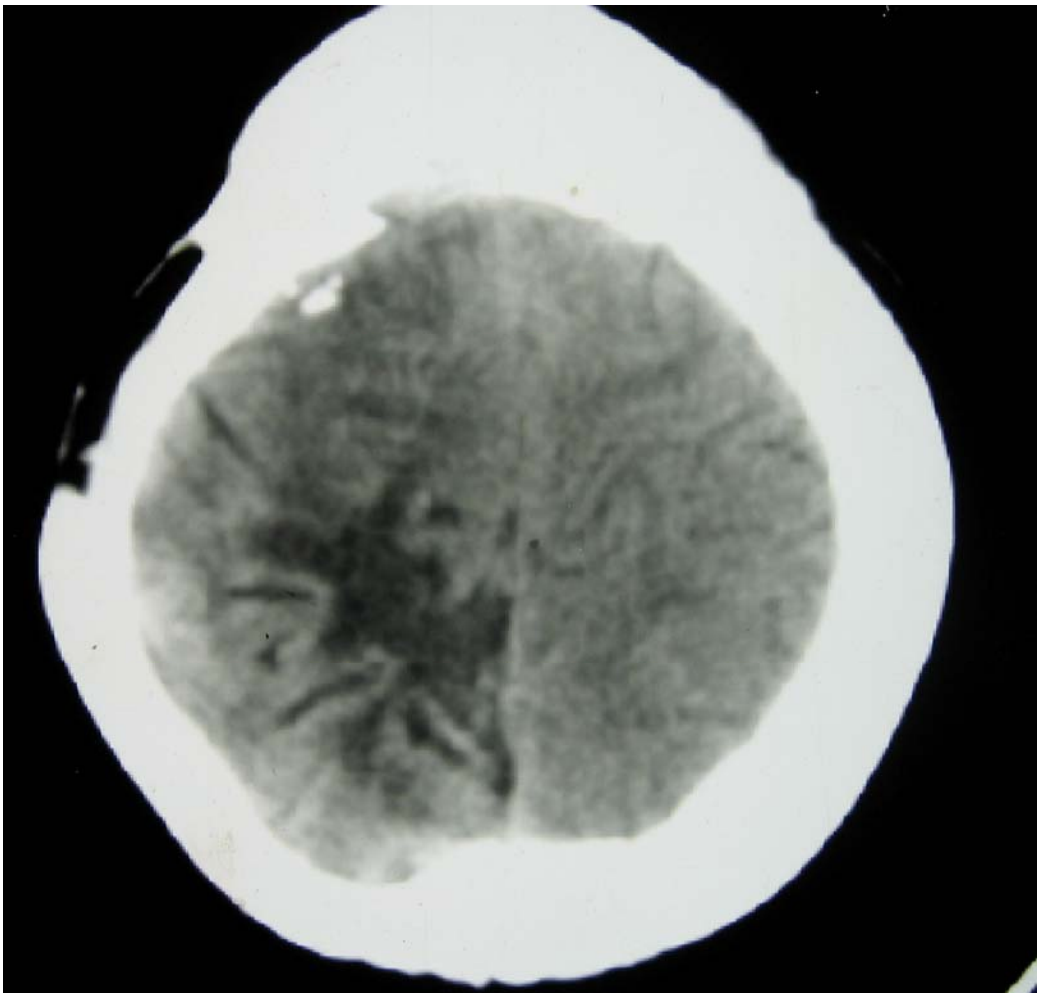
POST OPERATIVE PICTURE – CT BRAIN AXIAL VIEW



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RIGHT POSTERIOR THIRD PARASAGITTAL
MENINGIOMA – CT BRAIN CORONAL VIEW

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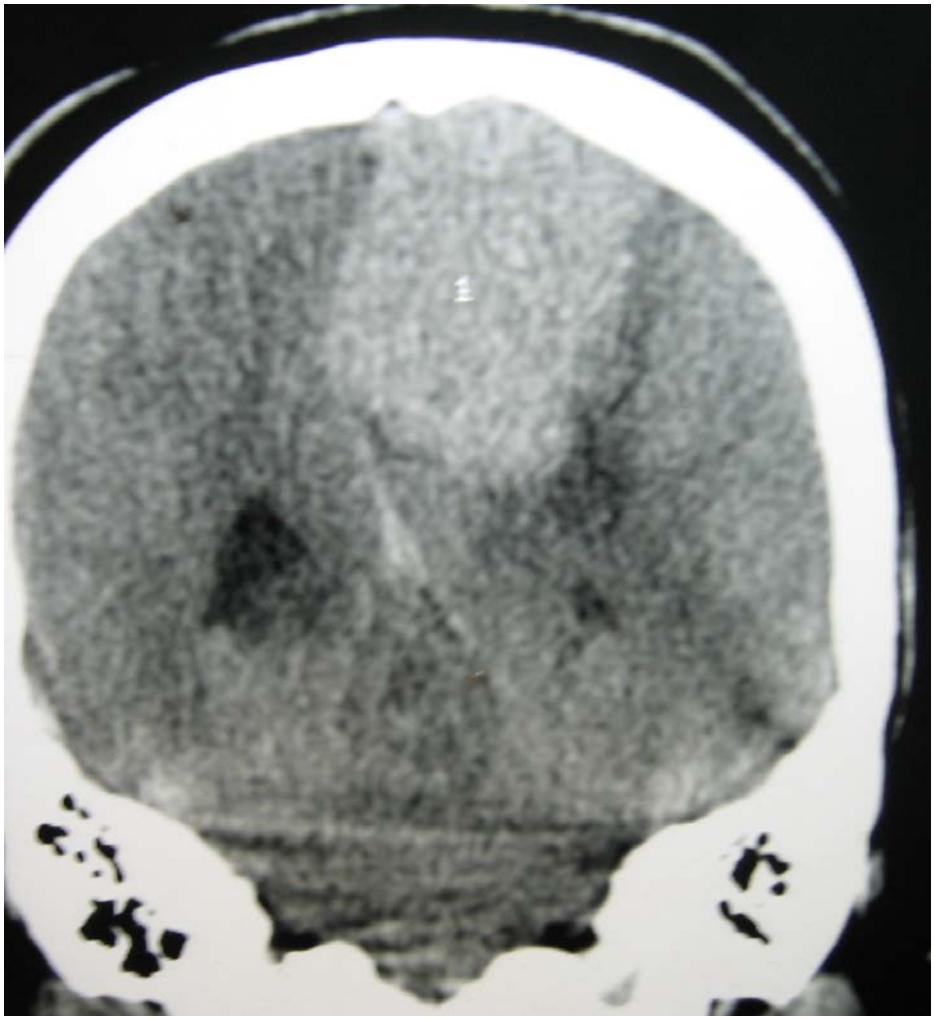
RIGHT POSTERIOR THIRD PARASAGITTAL MENINGIOMA –
CONTRAST CT BRAIN CORONAL VIEW



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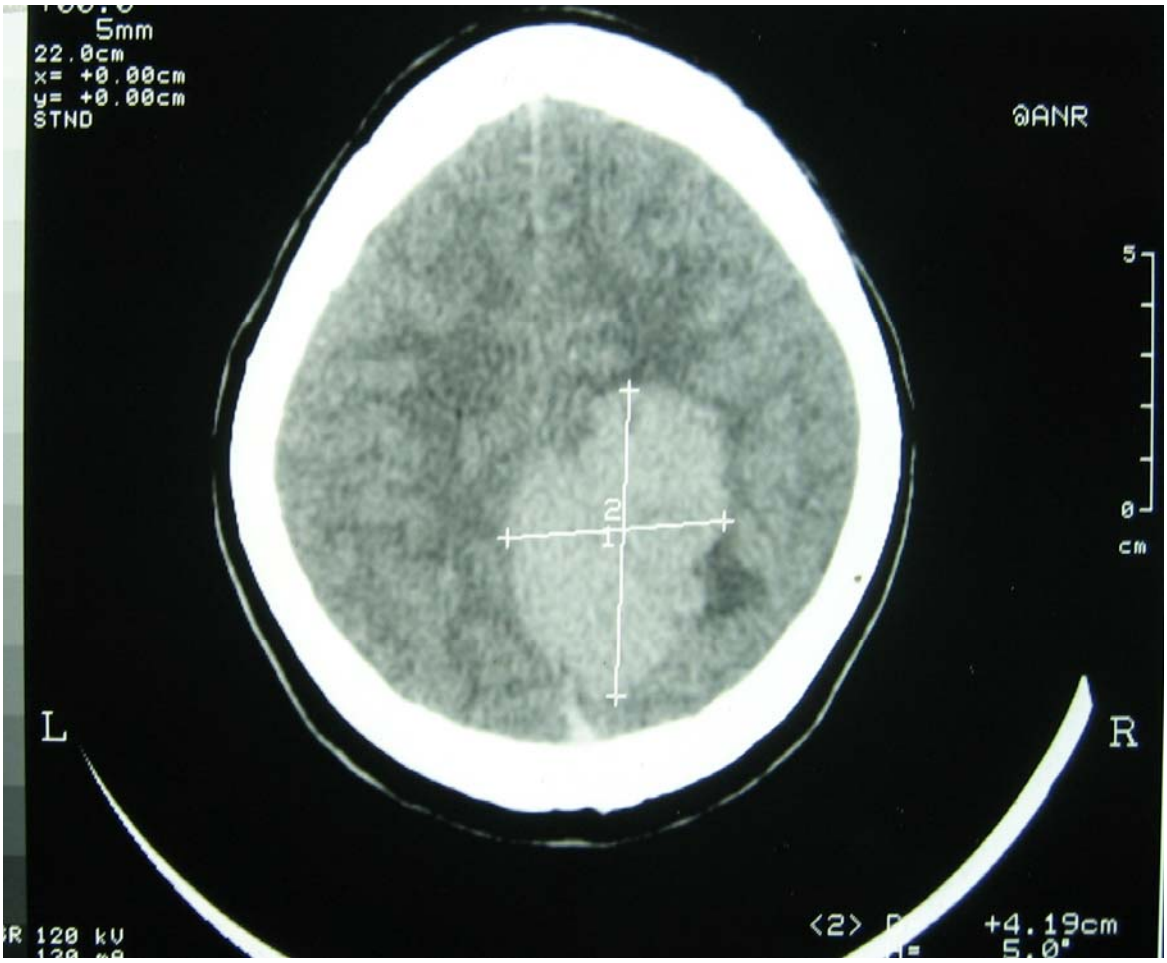
MENINGIOMA – CONTRAST CT BRAIN AXIAL VIEW



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MENINGIOMA – CT BRAIN AXIAL VIEW